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FEATURES OF THE USE OF SILK ROAD ART MOTIFS IN COSTUME DESIGN BASED ON AIGC TECHNOLOGY

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Abstract. ***Purpose*** *of the article: to analyse the possibilities of AIGC technology in the design of modern costumes using motifs of art from the Silk Road period..*

Methodology. *This study used a wide range of research methods: analysis, synthesis, systematisation and information processing. In studying the literature, we analysed documents on AIGC technology, Silk Road costume culture and fashion design innovation, organising relevant theories and research findings to provide a theoretical framework for the study.*

Results. *The article presents the results of an in-depth study of the mechanism of using AIGC technology in the integration of cultural heritage into design innovations. The article analyses how AIGC technology processes and transforms elements of art from the Silk Road period; it also provides recommendations for researching heritage in other traditional cultures. New methods and tools for designing clothing are proposed that allow designers to integrate elements of the Silk Road costume culture into modern design concepts, developing costume products with rich cultural connotations and market competitiveness. The transformation of historical cultural traditions into modern fashion through digital innovations contributes to the inheritance and development of the art of Silk Road costume and the prosperity of the design industry.*

Scientific novelty*. For the first time, an in-depth integration study of AIGC technology and modern costume design using motifs of Silk Road art was conducted; new possibilities for applying AIGC technology in the study of cultural heritage and design innovations were explored, and new ideas and methods for integrating Silk Road art into modern design were proposed..*

Practical relevance. *Using AIGC tools such as Midjourney for costume design, we have summarised a set of effective methods for designing Silk Road art motifs through case studies, providing practical tools and processes for designers..*

Keywords: *fashion design, design efficiency, cultural heritage, personalization and customization, AIGC, virtual try-on, technological innovation.*

INTRODUCTION

With the rapid development of Artificial Intelligence Generated Content (AIGC) technology, in the field of fashion design, it is rapidly changing the traditional design paradigm, process, and innovation effect. Using advanced technologies such as deep learning and big data analysis, AIGC technology can analyze and learn a large amount of design materials, generate creative design solutions, and provide designers with novel design ideas and sources of inspiration.

As an ancient trade route connecting the East and the West, the Silk Road not only promoted the exchange of material goods, but also cultural exchange and integration. Among them, dress culture is an important carrier of culture along the route, which contains rich historical, artistic and folklore information and has great cultural value. However, in contemporary times, the inheritance and development of Silk Road culture faces many challenges. On the one hand, with globalization and changes in modern lifestyles, traditional Silk Road dress culture is detached from contemporary life, and its unique craftsmanship and cultural connotations are at risk of being lost. On the other hand, traditional fashion design methods are difficult to meet the growing demands of modern people in terms of efficiency and innovation. Applying AIGC technology to the design of Silk Road elements can provide a new way of thinking to solve these problems.

ANALYSIS OF PREVIOUS STUDIES

In recent years, AIGC technology research has made remarkable progress. Many international research institutes and enterprises have invested a lot of resources in the research and development of AIGC technology, and made breakthroughs in various fields such as language, vision and audio processing, etc. OpenAI's GPT series of models performs well in text generation, and is able to generate high-quality articles, dialogues, and other contents; Stable Diffusion and Midjourney perform well in image generation, and can create realistic and creative images based on text descriptions, bringing new inspirations for design and art creation [4]. perform well in image generation, capable of creating realistic and creative images based on text descriptions, bringing new inspirations for design and art creation.

AIGC technology shows great potential in the field of fashion design. Studies have shown that AIGC technology can not only help designers think creatively, but also optimize design solutions through algorithms to improve design efficiency and personalization [2]. For example, Gu et al. (2023) reviewed the application of AI in fashion design and emphasized that AI techniques, especially Generative Adversarial Networks (GANs) and Diffusion Models, have become an important tool for fashion image synthesis, style transformation, and personalized recommendations. In addition, Lai et al. (2024) further verified the feasibility and effectiveness of AIGC in fashion design through an experimental study that combined AIGC technology with Big Five personality tests to provide a new strategy for personalized customization services for streetwear brands [6]. AIGC technology can quickly generate numerous design solutions and use algorithms to optimize and select the optimal solution, significantly improving design efficiency. Meanwhile, by integrating user preferences and body data, AIGC technology can achieve highly personalized design customization to meet the diverse needs of consumers [2].

AIGC technology can simulate and expand designers' creative thinking by generating different combinations of design elements and styles, providing designers with a source of inspiration. This interdisciplinary creative fusion helps to break the limitations of traditional design thinking and promote the innovative development of the fashion design industry [3]. By using virtual fittings and effect previews with AIGC technology, designers can effectively reduce design costs and risks. In addition, AIGC technology enables designers to respond quickly to market changes and consumer demands and adjust design solutions accordingly [6]. The introduction of AIGC technology brings new teaching modes and methods to apparel design education. Through the comprehensive application of participatory design and AIGC, students can understand the design principles and technical means more intuitively, and enhance their learning interest and creativity [17].

In the research field of Silk Road costume design, the academic community has deepened its interest in the study of Silk Road costume design and explored its inheritance and innovation in contemporary costume design. First of all, from a historical and cultural point of view, the Silk Road promoted the exchange and integration of clothing culture among different regions and ethnic groups. In his book Empire of Style: Silk and Fashion in Tang Dynasty China, Chen (2019) extensively discusses the influence of the Silk Road on Tang Dynasty clothing design, pointing out that Tang Dynasty clothing not only fused the traditional elements of the Han Chinese people in central China, but also absorbed styles from the Western Regions, Central Asia, and even Persia and India, resulting in the formation of a unique Tang Dynasty clothing culture. This cultural fusion is not only reflected in the materials and styles of clothing, but also profoundly affected the color combinations, pattern motifs and the use of accessories. Second, archaeological discoveries have provided rich physical materials for the study of Silk Road costume design [1; 19]. For example, Sheng (2023) introduced silk textiles unearthed from Astana Cemetery in Turpan, Xinjiang in Secrets of the Silk Road: Textiles and Trade along the Ancient Silk Road, which not only

demonstrated the exquisite craftsmanship of silk garments in the Tang Dynasty, but also reflected the cultural exchanges and influences along the Silk Road at that time [13]. Meanwhile, Doumani Dupuy et al. (2018), in "Eurasian textiles: a case study of exchanges during the early and late Silk Road", further revealed the textile exchanges during the early and late Silk Road through the study of textiles from southeastern Kazakhstan, which provided invaluable physical evidence for the understanding of the design of Silk Road garments [8].

From the perspective of globalization and cultural exchange, Silk Road clothing design is not only a product of ancient East-West cultural exchanges, but also an important manifestation of cultural diversity in the context of contemporary globalization. Knutson (2020) points out in Archaeology and the Silk Road Model that the Silk Road is an analytical model that provides an important theoretical framework for archaeological studies of global phenomena. She argues that the exchange of clothing designs along the Silk Road epitomized the process of globalization, reflecting the complex and diverse cultural interactions in ancient Eurasia. In contemporary times, with the acceleration of globalization, the elements of clothing culture along the Silk Road are increasingly integrated into international fashion design, becoming an important way to demonstrate cultural diversity and promote cultural exchange [14]. The importance of integrating the cultural elements of the Silk Road with modern fashion trends, innovating the expression of the humanistic elements of the Silk Road, and conveying the cultural story of the Silk Road through fashion design is emphasized to provide insights for the development of the fashion design field.

Although existing research recognizes the importance of Silk Road culture, there is still a lack of concrete practical cases and effective strategies for using AIGC technology to achieve cultural creative transformation and innovative development, and a systematic theoretical and methodological framework has not yet been established.

PURPOSE

The purpose of the article to analyse the possibilities of AIGC technology in the design of modern costumes using motifs of art from the Silk Road period.

RESULTS AND DISCUSSION

Principles and Development of AIGC Technology. AIGC technology, or Artificial Intelligence Generated Content technology, is cored on deep learning models such as Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer models. GANs consist of a generator responsible for generating new content and a discriminator used to judge the similarity between the generated content and real data, with both components competing and optimizing continuously to generate more realistic content.

The development of AIGC technology can be traced back to the 1950s at the earliest, and in the 21st century, with the development of the Internet and deep learning and other technologies, AIGC technology has entered a period of rapid growth. In 2006, deep learning algorithms made breakthroughs, laying the foundation for the practical application of AIGC technology. In 2014, the emergence of GAN further improved the quality of the generated content, which made it possible to apply AIGC technology in the field of images, text, audio, video, etc. In 2017, Google introduced the Transformer model to significantly enhance the natural language processing capabilities, thus vinegar make text generation more effective and better. Since 2022, ChatGPT, Midjourney and other representatives have led a new wave of AIGC development, which is widely used in various fields such as text, language, design, etc., and promotes the AIGC technology into real life [16; 18].

Current Application Status of AIGC in Design. AIGC technology has been more and more widely used in the design field, providing designers with novel creative tools and ideas. In the field of apparel design, AIGC technology analyzes fashion trends and consumer preferences based on design data from previous years, and can quickly generate diversified creative design sketches, providing designers with a source of inspiration. AIGC can also realize virtual fitting display according to the consumers' body shape, preferences and needs, so as to generate a design scheme that meets the consumers' personal styles. In terms of material selection, suitable material combination schemes can be selected according to the usage scenarios, and corresponding texture effect diagrams can be generated to visualize the materials [15]. In addition, when combined with virtual reality (VR) and augmented reality (AR) technologies, AIGC technology can achieve virtual try-on and display, enabling designers and consumers to view the effect of wearing garments in virtual environments, and comprehensively evaluate garment materials, patterns, colors, etc., so as to optimize the design scheme.

Cultural connotations of Silk Road costumes. The historical evolution of the Silk Road

costumes has a long history, and significant changes have occurred in style, color, pattern and other aspects. The opening of the Silk Road promoted the exchange and fusion of Eastern and Western cultures, so that the dress culture of the countries along the route influenced each other. Chinese silk, brocade and other handicrafts spread to the West, profoundly influencing Western fashion styles. At the same time, Western dress elements such as narrow-sleeved short clothes from the Western regions were also introduced to China, and were adopted and borrowed by the residents of the Central Plains. During this period, Silk Road costumes were diverse in style, colorful and rich in patterns, reflecting the cultural characteristics of different ethnic groups and regions.

With the passage of time, Silk Road costumes showed different characteristics in different historical periods. In the Tang Dynasty, when the prosperity of the Silk Road reached its peak, the dress culture also ushered in a glorious era. Characterized by its grandeur, bright colors and delicate patterns, Tang Dynasty costumes reflected the prosperous, open and tolerant cultural atmosphere of the Tang Dynasty. These features of costume art are vividly reflected in Dunhuang murals.

Nowadays, with the development of globalisation and the influence of fashion trends, costumes from the Silk Road period are one of the most valuable sources of inspiration for designers.Traditional elements of Silk Road costumes are integrated into modern design concepts, combining traditional patterns, colours, materials with contemporary styles and craftsmanship to create garments that have cultural connotations and are in line with modern aesthetics. In terms of styles, modern costumes place greater emphasis on comfort and practicality while also considering fashion sense and individuality. In terms of colors, in addition to preserving traditional color combinations, they also incorporate more fashionable colors, making clothing more colorful. In terms of patterns, not only traditional Silk Road pattern elements, such as the flying Apsaras and honeysuckle patterns in Dunhuang frescoes, are utilized but also modern design techniques are combined to innovate and transform patterns, making them more modern [20; 21].

Application of AIGC in Fashion Design. AIGC in fashion design.Midjourney is an AI art generator based on deep learning techniques such as Generative Adversarial Networks (GAN) and Diffusion Models. It can generate high-quality images. Its core consists of a generator and a discriminator. The generator is responsible for generating images based on input cues, while the discriminator is responsible for evaluating the similarity between the generated image and the real image and providing feedback to the generator to optimize the generated image. This adversarial training approach generates increasingly realistic, complex and creative images. In order to achieve efficient image generation, a large amount of text-image pair data is used in the training process. This data comes from a variety of image sources on the Internet and covers a wide range of topics, styles and content. By learning from this data, the features and patterns of different images can be captured to accurately generate images that meet the cue requirements during the generation process [9].

Midjourney Text-to-Image is one of the core features of Midjourney, allowing users to quickly generate corresponding images by typing in a text description or image fusion. In fashion design, designers can simply type in prompts such as "a red dress with Silk Road elements, featuring lightweight silk fabric and gold embroidery patterns" to generate multiple renderings of the dress that match the description in a short period of time, providing designers with creative inspiration and design direction. This feature breaks through the limitations of traditional hand-drawn sketches and significantly improves design efficiency, enabling designers to explore multiple design possibilities in a short period of time [10].

Design Process and Methods. Inspiration and Concept Stage. In the early stages of fashion design, Midjourney offers unique ways to inspire designers. By inputting keywords related to the Silk Road, Midjourney can quickly generate corresponding images, serving as an important source of design inspiration. After gaining inspiration, designers extract key elements such as clothing styles, patterns, and colors from these images and integrate them into their fashion design concepts based on their own design philosophies. At the same time, by adjusting Midjourney's prompts and interacting with Midjourney based on existing concepts, designers can change descriptions of clothing styles, materials, patterns, etc., prompting it to generate new images, thus efficiently transforming from inspiration capture to concept generation, laying the foundation for subsequent design [5].

After completing the initial concept design, Midjourney's various functions assist in advancing series design. The image-to-image function allows designers to upload preliminary fashion design sketches, and Midjourney will generate related new images based on their

styles and elements. Designers can obtain diverse design schemes by adjusting prompts to form a series. The image overlay function supports designers in uploading reference images related to the Silk Road and generating images that fuse multiple elements in combination with prompts. The multi-image-to-image function can fuse elements from multiple reference images of different types. After describing the design style characteristics, Midjourney can generate clothing that integrates traditional and modern elements, breaking through the limitations of traditional design thinking and meeting consumers' demand for novel and unique clothing, realizing the evolution and expansion of series design.

Element Processing and Design Operations. When designing AIGC-featured Silk Road fashion elements, it is first necessary to conduct in-depth research on historical documents, archaeological data, and existing artifacts of Silk Road clothing, extracting representative elements such as clothing styles (e.g., wide robes and sleeves of Hanfu, narrow-sleeved short tunics of Hu clothing), patterns (e.g., flying apsaras and honeysuckle patterns in Dunhuang murals), colors (referencing traditional colors of countries along the route), materials (silk, cotton, etc.), and crafts (embroidery, printing, etc.). After extraction, the elements are digitally processed, with pattern elements being converted into JPEG, PNG, and other formats through image scanning and digital drawing, and optimized using image processing software. Color elements are converted into RGB, CMYK, and other digital color modes using color management tools. Designers can browse and screen out images that meet the requirements for further optimization. During this process, Midjourney will continue to learn and optimize. If the results differ significantly from expectations, pro mpts and parameters can be adjusted again for regeneration [11] (Fig.1).

Screening and optimizing results. Project outcomes are diverse and innovative, but validation is needed to select the most appropriate outcomes. For example, from an aesthetic point of view, it is necessary to determine whether the color combinations, pattern arrangements and shapes are in line with modern aesthetics and whether they are aesthetically pleasing and harmonious. Whether it reflects the cultural characteristics of the Silk Road, and whether it incorporates the cultural elements of the countries along the route in terms of cultural connotation. The outlines and lines of the selected patterns can be optimized by manual fine-tuning according to the proportion of the human body and the need to wear, the patterns can be adjusted according to the details generated by Midjourney, and the colors can be adjusted according to the principles of collocation and personal preferences. Further enhancements can be made using software tools such as Photoshop, Illustrator, etc., such as adjusting brightness, contrast and color saturation.

Design Practice Case: Modern Evening Dress Design with Dunhuang Elements. Inspired by the flying apsaras in Dunhuang murals, Midjourney was used to design a modern evening dress. During the Sui Dynasty, the "Double Flying Apsaras" were renowned for their unparalleled speed and the most exquisite sense of flight of any celestial body. This is determined by the rhythmic flow of their banded forms, exuding a distinctive artistic appeal characterized by effortless elegance, free, fast and precise brushstrokes, and striking but harmonious color contrasts, as exemplified in these two flying figures [22]. The "Three Rabbits and

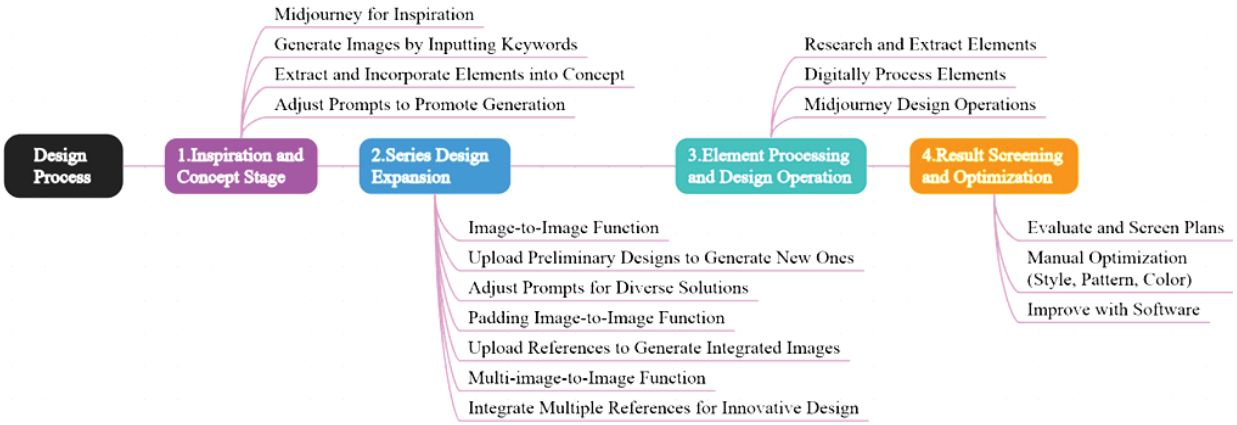

Fig. 1. Design Process, created by the author. China, 2025

Flying Apsaras" of the Sui Dynasty captivates the viewer with its exquisite group of celestial figures encircling a mandala. At the center of the rotation of these flying figures, a lotus flower in full bloom appears. In the serene heart of this lotus flower, three rabbits run around. The Dunhuang artist skillfully created visual delight by depicting only three intertwined rabbit ears instead of the expected six. The liveliness of the white rabbits, the swirling ribbons, and the undulating fabric together form a dynamic caisson ceiling [23]. All of these Dunhuang murals delicately demonstrate the unique artistic characteristics of the costumes of that period.

In the early stages of design, the designer conducted in-depth research on the postures, clothing, colors, and other elements of the flying apsaras in Dunhuang murals, extracting representative elements such as the flying ribbons of the flying apsaras, pleats of the long skirts, lotus patterns, and commonly used colors in Dunhuang murals, such as malachite green, ochre, cinnabar, etc (Fig.2, a, b).

These elements were converted into prompts that Midjourney could understand, such as "a floor-length white evening dress with Dunhuang flying apsara ribbon elements, featuring lotus pattern embroidery on the skirt, crafted from lightweight silk fabric, with an off-the-shoulder neckline design, paired with gold accessories, and a background pattern in the style of Dunhuang murals." (Fig.3).

After entering the prompts, Midjourney quickly generated multiple design images. These images showcase a wide variety of design styles. Some of the evening gowns feature elegant, flowing ribbons, like flying fairies fluttering in the clouds; rich ruffles are displayed

a *b*

Fig. 2, a. Double Flying Apsaras in Cave 305, Mogao Grottoes, Dunhuang (Sui Dynasty), [22];
b. Three Rabbits and Flying Apsaras in Cave 407, Mogao Grottoes, Dunhuang (Sui Dynasty), [23]

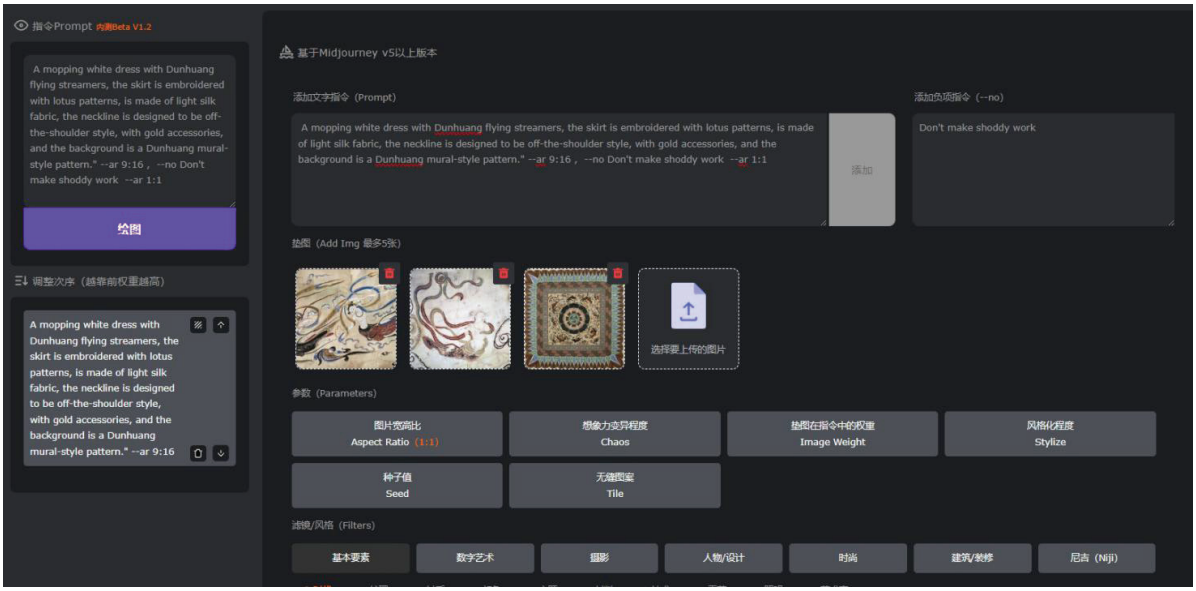

Fig. 3. Midjourney prompt, created by the author, China, 2025

Чжан Фен, Кротова Т. Особливості використання мотивів мистецтва періоду Шовкового шляху в дизайні костюма на основі технології AIGC. *Теорія та практика дизайну. Культура і мистецтво.*
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on the skirts, with a layered, three-dimensional effect; and floral motifs are distinctly featured, looming in and out of the background, making the evening gowns even more artistic. In terms of color matching, the colors of Dunhuang murals are skillfully integrated, and the combination of ochre and gold adds a sense of grandeur to the evening gowns (Fig. 4, a-h).

After screening, an image with a unique ribbon design and harmonious color matching was selected for optimization. Using Adobe Photoshop software, details of the evening dress were processed, such as adjusting the shape and length of the ribbons to make them more natural and flowing; adjusting color saturation and brightness; and performing background cutout

a *b* *c* *d*

e *f* *g* *h*

Fig. 4. Multiple design images generated by Midjourney for selection, created by the author, China, 2025

processing (Fig.5, a-d). This modern evening dress that fuses Dunhuang elements not only retains the charm of Dunhuang culture but also showcases the appeal of modern fashion, providing new ideas and methods for the inheritance and innovation of Dunhuang culture.

The World's First AI Fashion Show in New York and Analysis of the Works. In recent years, the rapid development of artificial intelligence technology has gradually extended to the fashion industry, giving rise to new design concepts and models. The world's first Artificial Intelligence fashion show held in New York is a concentrated manifestation of this trend. The event, co-organized by creative studio Maison Meta and e-commerce giant Revolve, took place on April 20-21, 2023 in New York. The fashion show attracted more than 400 designers from all over the world, who used AI technology to create a wide range of digital designs that showcased the latest in the fusion of AI and fashion. These works not only highlight the unique advantages of AI in design efficiency and idea generation, but also reflect the designers' innovative spirit of breaking through traditional boundaries and taking risks [7]. The fashion show further inspired the creative enthusiasm of the designers and promoted the awareness and acceptance of AI technology in the fashion industry. Among the works presented at the show, the collection of Brazilian designer ARIA PHENIX attracted attention.

For the Ipanema Resort 2023 collection [12], ARIA PHENIX was deeply inspired by natural landscapes, especially the magical colors and romantic atmosphere that unfold on the beach at sunset. In order to incorporate this inspiration into the design, the designer used the power of Artificial Intelligence (AI) technology. Through AI, she was able to quickly capture and transform the fleeting colors of the sunset into concrete design elements. In terms of fabric selection, a light and airy cotton fabric was chosen, which perfectly demonstrates the softness and romance of the sunset, and these laces blend with the fabric as if they were a

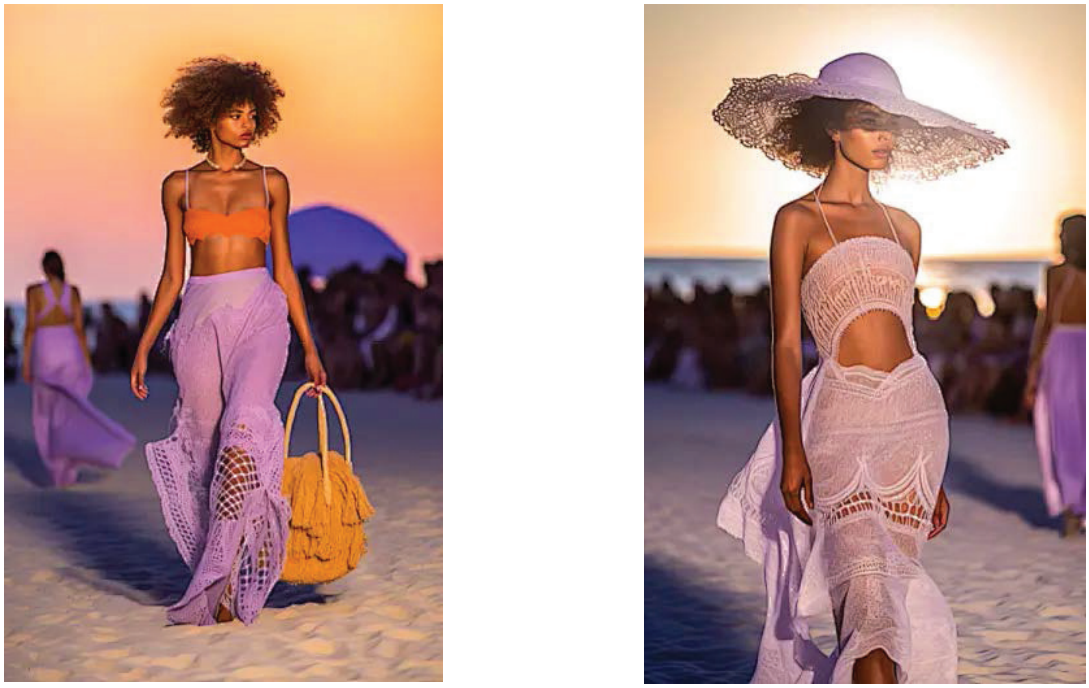
a *b*

c *d*

Fig. 5. Optimized design after style selection, created by the author, China, 2025

dreamy recreation of the salty bubbles on the surface of the sea. And in this collection, she purposely designed the pairing without shoes, so that the wearer can personally feel the softness and delicacy of the beach under their feet.

As the sun gradually bids farewell to the day and the night slowly descends, a visual feast of color, contrast and intensity is staged, as if being brought into a dream world full of romance and mystery (Fig.6, a, b).



a *b*

Fig. 6. ARIA PHENIX. Models from the collection created with the help of AI. New York AiFashionweek, 2023 [12]

CONCLUSIONS

By analyzing the above works, it is clear that AI's contribution to fashion design goes far beyond increasing efficiency. He also helps to inspire designers to push the boundaries of traditional design frameworks. This includes the skillful fusion and innovative interpretation of Silk Road grotto motifs, which are designed to give a vibrant contemporary flavor to modern clothing while maintaining traditional aesthetics. In addition, the first Artificial Intelligence Fashion Show held again in New York is not only an innovative attempt in the fashion industry, but also a testimony to the organic combination of artificial intelligence technology and fashion design. It reveals the great potential and bright future contained in the fusion of fashion design and AI technology.

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АНОТАЦІЯ

Чжан Фен, Кротова Т. Особливості використання мотивів мистецтва періоду Шовкового шляху в дизайні костюма на основі технології AIGC

***Мета** дослідження: проаналізувати можливості технології AIGC в дизайні сучасного костюма з використанням мотивів мистецтва періоду Шовкового шляху.*

***Методологія.** У цьому дослідженні використано широкий спектр методів дослідження: аналізу, синтезу, систематизації та обробки інформації. Вивчаючи літературу, ми проаналізували документи про технологію AIGC, культуру костюма Шовкового шляху та інновації в дизайні одягу, впорядкувавши відповідні теорії та результати досліджень, щоб забезпечити теоретичну основу для дослідження.*

***Результати**. Викладено результати поглибленого вивчення механізмів використання технології AIGC в інтеграції культурної спадщини в дизайн-інновації. Проаналізовано, як технологія AIGC обробляє, трансформує елементи мистецтва періоду Шовкового шляху; викладено рекомендації для дослідження спадщини в інших традиційних культурах. Запропоновано нові методи і інструменти проєктування одягу, які дозволяють дизайнерам інтегрувати елементи культури костюма Шовкового шляху в сучасні концепції дизайну, розробляючи вироби костюма з насиченим культурним підтекстом і ринковою конкурентноздатністю. Трансформація історичних культурних традицій у сучасну моду за допомогою цифрових інновацій сприяє наслідуванню і розвитку мистецтва костюма періоду Шовкового шляху та процвітанню індустрії дизайну.*

***Наукова новизна.** Вперше проведено поглиблене інтеграційне дослідження технології AIGC і дизайну сучасного костюма з використанням мотивів мистецтва періоду Шовкового шляху; досліджено нові можливості застосування технології AIGC у вивченні культурної спадщині та дизайн-інноваціях, запропоновано нові ідеї та методи інтеграції мистецтва Шовкового шляху в сучасний дизайн.*

***Практична значущість**. Використовуючи інструменти AIGC, такі як Midjourney, для проєктування костюма, ми узагальнили набір дієвих методів дизайну мотивів мистецтва Шовкового шляху через аналіз конкретних прикладів, надаючи практичні інструменти та обґрунтовуючи процеси для дизайнерів.*

Ключові слова: дизайн одягу, ефективність дизайну, культурна спадщина, персоналізація та кастомізація, AIGC, віртуальна примірка, технологічні інновації.

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